



24.3 Waves and Energy

READ



A wave is an organized form of energy that travels. The amount of energy a wave has is proportional to its frequency and amplitude. Therefore, higher energy waves have a higher frequency and/or a higher amplitude. Remember that the frequency is measured in hertz. The frequency of 1 Hz equals one wave cycle per second.

EXAMPLE

For each set of diagrams, identify which of the standing waves has the highest energy and which has the lowest energy.

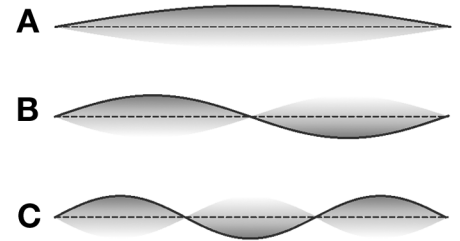
Answers for frequency and energy:

Standing wave	Frequency	Energy
A	lowest	lowest
B	medium	medium
C	highest	highest

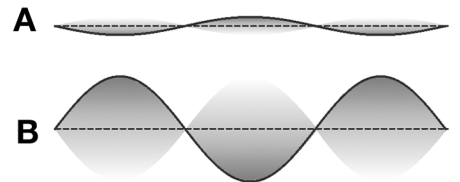
Answers for amplitude and energy:

Standing wave	Frequency	Energy
A	lowest	lowest
B	highest	highest

Frequency and energy



Amplitude and energy



PRACTICE

- When you drop a stone into a pool, water waves spread out from where the stone landed. Why?
- Ian and Igor have opposite ends of a jump rope and perform the following demonstration. First they moved the rope up and down one time a second, then two times a second, and then three times a second. Describe the trend in frequency for the jump rope and the trend in energy used by Ian and Igor for this demonstration.
- One wave has a frequency of 30 Hz and another has a frequency of 100 Hz. Both waves have the same amplitude. Which wave has more energy?
- On a calm day ocean waves are about 0.1 meter high. However, during a hurricane, ocean waves might be as much as 14 meters high. If both waves have the same frequency, during which set of conditions do the waves have more energy?
- Which wave has more energy: a wave that has an amplitude of 3 centimeters and a frequency of 2 Hz or a wave with an amplitude of 3 meters and a frequency of 2 Hz?
- The loudness of sound is related to its amplitude. Which sound wave would have the least energy: a low-volume wave at 1,000 Hz or a high-volume (loud) wave at 1,000 Hz?
- The frequency of microwaves is less than that of visible light waves. Which type of wave is likely to have greater energy?
- Standing wave C in the first graphic above represents 1.5 wavelengths. Draw a standing wave that represents 2 wavelengths. Compare the energy and frequency of this standing wave to A, B, and C.